LORAIN

Products Corporation

Mount

LORAIN MODEL ND INTERRUPTER

Spec. No. 5873-808 Serial No. 603

instructions

INSTALLATION
OPERATION
MAINTENANCE

DESIGNERS AND MANUFACTURERS OF

power equipment without moving parts SUB-CYCLE® CONVERTERS AND FLOTROL® RECTIFIERS

FOR PARTS OR SERVICE
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Mount

LORAIN MODEL ND INTERRUPTER

Spec. No. 5873-808 Serial No. 603

5454-01G 291

LORAIN PRODUCTS CORPORATION WARRANTY

Seller warrants that the products it manufactures or sells shall be free from defects in material and workmanship during the first 90 days after the product is activated. During said period, Seller will repair or replace any defective parts free of charge to Buyer, including any labor costs. In addition, Seller shall repair or replace any defective parts, so discovered by Buyer to be defective within two years from the date of shipment of same, provided Buyer promptly so notifies Seller. In no case shall Seller's liability under this warranty extend beyond two years from the date of shipment of said product. This warranty shall not apply to any products which are misused, modified, repaired, or otherwise abused by Buyer or others. The repair or replacement of defective parts, or the refund of the invoice cost thereof, as shall be determined by Seller in its sole discretion, shall be the limit of Seller's liability hereunder and shall be Buyer's sole and exclusive remedy.

Handling or service charges in connection with the return of such products, if approved by Seller, shall be charged as determined by Seller. Seller shall not be liable in any event for any general or special, incidental or consequential damages to Buyer in excess of the amount of the purchase price of the product.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES. SELLER MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE WITH RESPECT TO ANY PRODUCTS EXCEPT AS HEREIN EXPRESSLY PROVIDED.

Systems and Equipment Not Economically Returnable To The Factory

In the event that the product involved is a system or equipment which, in the judgment of Lorain Products Corporation, is not economically returnable to the factory or if Lorain Products Corporation has performed the installation, supervised the installation, or performed testing and turn-on, circuit components and Lorain repair labor are covered by this warranty for the first 90 days from date of turn-on and circuit components are warranted for two years from the date of shipment. Upon request, Lorain will send a service technician to the site to determine if the unit is defective in circuit components or workmanship, and will repair the equipment. If the failure is Lorain's fault, no invoice for circuit components or repair labor will be issued if the complaint has been issued within the first 90 days from date of turn-on. If the complaint is issued more than 90 days from the date of turn-on but within two years from the date of shipment, the customer will be billed at the prevailing Customer Service rates but will not be billed for circuit components. If the problem occurs after two years from the date of shipment, circuit components and repair labor are billable.

If the problem has been created by misuse or abuse of the equipment or by malfunction of associated equipment or by environmental conditions, at any time after shipment, the customer will be billed for circuit components and labor.

General Provisions

Lorain Products Corporation shall not be obligated to pay any costs or charges incurred by the customer or by any other party. In no event will Lorain Products Corporation be liable for consequential damages. No waiver, alteration or modification of any of the provisions herein shall be binding on Lorain Products Corporation unless in writing and signed by an authorized official of Lorain Products Corporation. If, during any warranty period, the subject equipment has, in the opinion of Lorain Products Corporation, been modified or misrepaired, the warranty will be void unless the modifications or repairs have been made after consultation with the corporation and upon the recommendation of the corporation.

WARNING

THE PRINTED CIRCUIT BOARDS IN THIS EQUIPMENT CONTAIN STATIC SENSITIVE DEVICES. THE WARNINGS LISTED BELOW MUST BE OBSERVED IN ORDER TO PREVENT DAMAGE TO THESE DEVICES. DISREGARDING ANY ONE OF THE WARNINGS MAY RESULT IN PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT.

1. DO NOT INSERT OR REMOVE PRINTED CIRCUIT BOARDS WITH THE POWER ON. WAIT AT LEAST 5 MINUTES AFTER POWER IS TURNED OFF (OR UNTIL POWER SUPPLIES HAVE DISCHARGED TO ZERO) BEFORE REMOVING ANY BOARD.

2. BEFORE TOUCHING ANY STATIC SENSITIVE DEVICE OR PRINTED CIRCUIT BOARD CONTAINING SUCH A DEVICE, DISCHARGE ALL STATIC ELECTRICITY FROM YOURSELF BY WEARING A WRIST STRAP GROUNDED THROUGH A ONE MEGOHM RESISTOR.

3. DO NOT TOUCH THE TRACES OR COMPONENTS ON A PRINTED CIRCUIT BOARD CONTAINING STATIC SENSITIVE DEVICES. HANDLE THE PRINTED CIRCUIT BOARDS ONLY BY THE EDGES THAT DO NOT HAVE CONNECTOR PADS.

4. AFTER REMOVING A PRINTED CIRCUIT BOARD CONTAINING A STATIC SENSITIVE DEVICE PLACE THE PRINTED CIRCUIT BOARD ONLY ON CONDUCTIVE OR ANTI-STATIC MATERIAL SUCH AS CONDUCTIVE FOAM, CONDUCTIVE PLASTIC, OR ALUMINUM FOIL. DO NOT USE ORDINARY STYROFOAM OR ORDINARY PLASTIC.

5. STORE AND SHIP STATIC SENSITIVE DEVICES OR PRINTED CIRCUIT BOARDS CONTAINING SUCH DEVICES ONLY IN CONDUCTIVE OR ANTI-STATIC CONTAINERS.

6. IF NECESSARY TO REPAIR A PRINTED CIRCUIT BOARD CONTAINING A STATIC SENSITIVE DEVICE, WEAR A WRIST STRAP GROUNDED THROUGH A ONE MEGOHM RESISTOR, WORK ON A CONDUCTIVE SURFACE, USE A GROUNDED SOLDERING IRON, AND USE GROUNDED TEST EQUIPMENT.

Printed in U.S.A. April 23, 1979 Form 3653

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CAIXA POSTAL 30435
01000 SAO PAULO BRASIL
TLX 01121764 1121764BIB BR

CAUTION!

Do not use a test receiver or "earphone" to check interrupter outputs unless it is a high impedance test receiver. Most test receivers used in telephone offices are of low enough resistance to draw excessive current through the mercury relay contacts. If in doubt about impedance of test receiver, connect a 500 ohm resistor in series with the test receiver. If this precaution is not followed, the mercury relay contacts may be instantly destroyed without any visible sign of damage.

MODEL ND INTERRUPTER
SPEC. NO. 5873-808

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1. DESCRIPTION

General

1.01 LORAIN Model ND Interrupter, Spec. No. 5873-808, operates from nominal 48 volt DC to furnish ground pulse signals and interrupted (user furnished) low tone. The Interrupter consists of two completely separate and independent solid-state interrupter circuits.

2. INSTALLATION

Location

2.01 The Interrupter is designed to operate in a well ventilated area which has an ambient temperature range of 0°C (+32°F) to +50°C (+122°F).

Mounting

2.02 The Interrupter can be mounted in a twenty-three inch relay rack. It requires 3-1/2 inches of panel space, extends 4-3/4 inches to the front of the rack, and has an overall depth of 11-3/4 inches.

CAUTION: In mounted position, ventilation openings at the top and bottom of the cabinet must be unobstructed. The temperature of the air entering the bottom of the cabinet should not exceed 50°C. If this unit is mounted in a relay rack with other equipment, it is recommended that 1-3/4 inches of ventilation space be provided above and below the cabinet; this is essential for proper cooling during operation.

Electrical Connections

2.03 Installer connections are made at a one-hundred point wire wrap type terminal block TB1 at the right side as viewed from the rear of the Interrupter. These connections are indicated on Schematic Diagram SD-5873-808 and are also summarized and described below. Timing of output signals is shown in timing chart on Schematic Diagram SD-5873-808.

a) This Interrupter supplies the following ground pulse signal (Output):

Signal Ref. Desig	Terminals on Terminal Block TB1 Int 1	Int 2
MK1	J3	E3
MK2	I3	D3
MK3	H3	C3
MK4	J4	E4
MK5	I4	D4
2R	J7	E7
T1	H4	C4
T2	J5	E5
CD1	G4	B4
RC1	I7	D7
RC2	H7	C7
GC1	I5	D5
GC2	H5	C5
GC3	J6	E6
GC4	I6	D6
GC5	H6	C6
PU	G6	B6
60	I8	D8
120	H8	C8

NOTE: The ground pulse signals are rated at 1.0 ampere. The quad ground switch circuit cards are equipped with a current limiting circuit which, in effect, will hold the ground switch circuits off until the load current drops below 2.0 amperes. (Refer to Operation Section for a detailed description.)

b) Connect external low tone supplies (user furnished) at terminals J10 (Int 1) and E10 (Int 2). Connect low tone returns at terminals H10 (Int 1) and C10 (Int 2). Interrupted trunk busy tone will be provided ta the following terminals:

Signal	Trunk Busy Tone Output Terminal on TB1 Int 1	Int 2
TBY	I10	D10

c) Connect external low tone supplies (user furnished) at terminals J9 (Int 1) and E9 (Int 2). Connect low tone returns at terminals H9 (Int 1) and C9 (Int 2). Line busy tone will be provided at the following terminals:

Signal	Line Busy Tone Output Terminal on TB1 Int 1	Int 2
LBY	I9	D9

d) Supply -48V DC at terminals H1 (Int 1) and C1 (Int 2). Connect terminals J1 (Int 1) and E1 (Int 2) to office ground.

e) The main battery input of both Interrupter 1 and Interrupter 2 is fused internally using a 1-1/3 ampere fuse. In the event of an open fuse, resistance battery will be provided at terminal J2 (Int 1) or E2 (Int 2) for actuation of external alarms, if connected.

3. CIRCUIT CARDS AND POWER SUPPLY

3.01 Twelve separate, independently-removable, plug-in circuit cards and two power supply assemblies make up this Interrupter. It is recommended that one spare circuit card be kept for each type of circuit card listed below:

Ref. Desig. Int 1	Int 2	Description Part No.	Name
A1	A12	4874-044	Timing Generator
A2-5	A8-11	4866-096	Quad Grd Switch
A6	A7	4866-095	Quad Switch
PS-1	PS-2	4865-067	Power Supply

To gain access to plug-in type circuit cards, pull front cover of the Interrupter forward. To gain access to power supply assemblies, swing rear cover downward. If a failure should occur in any plug-in circuit card, it can easily and quickly be withdrawn forward from its connector and a replacement card of similar type can be installed immediately to maintain service. Each connector has a polarizing key which insures that a circuit card cannot be installed at a position at which it would be damaged. The power supplies may be removed by first unplugging the five wires from pins 1-5, then remove the six screws which secure the power supply assembly to the interrupter's rear cover. If it becomes necessary to replace the main battery input fuse F3 or F5, replace only with a 1-1/3 amp GMT type fuse.

4. MANUFACTURER'S ADJUSTMENT

4.01 Potentiometer R3 of timing generators A1 and A12 are adjusted at the factory to set the pulse rate at 20 Hz. It is recommended that no change be made to either potentiometer setting.

5. CIRCUIT DESCRIPTION

General

5.01 Because this Interrupter consists of two identical Interrupfer circuits, the descriptions of the one below may be taken as typical operation for either Interrupter. Schematic Diagram SD-5873-808 shows the electrical circuitry and timing pattern of the Interrupters.

Timing Generator (Part No. 4874-044)

5.02 This circuit consists of a clock, counter, and decoder circuits, the clock circuit consisting of CLK (A1) resistors R2-R4 and capacitors C2 and C3 is a pulse generator operating at a 20 Hz rate. Potentiometer R3 is used to set the clock rate at 20 Hz. The counter circuit consisting of flip-flops FF1-FF5, divide by 10 counter CTR1, divide by 8 counter CTR 2, divide by 5 counter CTR3, capacitors C1 and C4, diodes CR1-CR4, and resistors R1 and R5-R7 produces the required timing pattern from the clock pulses. The decoder circuit consisting of G2-G20 decodes the basic -10V timing pattern into the required output functions. This circuit operates from a regulated 10 volt supply; typical current is 10 MA.

Quad Ground Switch (Part No. 4866-096)

5.03 The quad ground switch circuit consists of four independent one ampere ground switches. The four switches all operate in the same manner; therefore, the description of the one given below may be taken as a typical operation for all. Cross-coupled gates G1 and G5 form an RS flip-flop, which is biased by resistor R20 in such a manner that the output of gate G1, at pin 10, will be low when the signal on pin 9, of gate G1, is absent. When a low control signal (-10V) is applied to pin 9 of gate T1, the output state of the RS flip-flop is unchanged. However, the low control signal is coupled to pin 2 of gate G2, making the output at pin 3 of gate G2 high (+GRD). This high signal is inverted by gate G3 and applied to the base of transistor Q1 through resistor R1, causing Q1 to conduct. The conduction of Q1 causes ground to be applied through resistor R3 to board connector pin 1 (OUTPUT 1).

5.04 When the control signal is removed, pin 3 of gate G2 becomes low; this signal is inverted by gate G3 to a high signal causing Q1 to stop conducting.

5.05 When the load current through R3 and R24 reaches approximately two amperes, the voltage drop across them is one volt. Linear amplifier G4 compares this voltage to the voltage developed across resistor R5. When the voltage across resistor R3 is greater than the voltage across resistor R5, linear amplifier G4 will stop conducting, thus causing a high signal at pin 2 of gate G5. This voltage causes the RS flip-flop to toggle so that pin 10 of gate G1 is high. In this condition, the output of gate G3 will be low (regardless of the state of the control signal) and Q1 cannot conduct until the load current becomes less than two amperes.

5.06 When Q1 is conducting, the ground output signal is applied to light emitting diode DS1, causing it to light. If Q1 is not conducting, DS1 is not lit, therefore, DS1 provides a visual indication of the ground switch.

Quad Switch (Part No. 4866-095)

5.07 The quad switch circuit consists of four independent interrupter switches. The four switches all operate in the same manner, therefore, the description of the one given below may be taken as a typical operation for all.

5.08 When a low control signal (-10V) is applied to pin 3 of buffer A1, the output of A1, at pin 2, becomes low. This low signal is applied to the base of transistor Q1 through resistor R1, causing Q1 to conduct. When transistor Q1 conducts, ground is applied to the coil of relay K1 through light emitting diode DS1 causing K1 to operate and DS1 to light.

5.09 When the control signal is removed, transistor Q1 stops conducting causing K1 to release and DS1 to extinguish; therefore, DS1 provides a visual indication of the state of relay K1. The contacts of K1 may be used to switch tone on and off to provide, for example, interrupted busy or overflow tone.

Power Supply (Part No. 4865-067)

5.10 The power supply circuit furnishes -10 volts to all circuit cards in the Interrupter. A surge absorbing circuit is provided to protect the output transistors in the ground switches. The surge absorbing lead is designated "SA".

5.11 The -10 volts required for the Interrupter circuit card operation is developed across zener diode CR3.

5.12 The surge absorbing circuit is composed of zener diode CR2, resistor R5, and capacitor C1. During normal operation, C1 is charged to 48 volts through CR1. When a voltage surge appears on the "SA" lead, the voltage rises across CR2 until its breakdown voltage is reached, about 12 volts. At this point, the voltage on the "SA" lead equals battery voltage plus the zener diode voltage, or about 60 volts, and any increase in voltage causes a current to flow which charges C1, thus limiting the surge voltage. When the surge has passed, C1 discharges through resistors R1-R4 until its voltage is again 48 volts. R5 limits the initial charging current of C1 when the Interrupter is started.

6. TROUBLESHOOTING

6.01 Different types of failures will cause different trouble symptoms unique to that failure. The following steps should be taken in localizing and correcting the trouble:

CAUTION: DO NOT WITHDRAW AND/OR INSERT CIRCUIT CARDS WHILE INTERRUPTERS ARE IN OPERATION, OR DAMAGE MAY OCCUR TO CIRCUIT CARDS. BEFORE HANDLING ANY CIRCUIT CARDS, READ AND FOLLOW THE INSTRUCTIONS CONTAINED ON THE WARNING PAGE WHICH PRECEEDS THIS INSTRUCTION FORM.

a) Locate the signal designation(s) printed on the front cover of the Interrupter which corresponds to the signal(s) which are absent, continuous, or irregular. Compare the lighted intervals of the LED's with the timing chart on Drawing SD-5873-808.

b) Remove the front cover and withdraw the circuit card(s) that corresponds to the absent, continuous, or irregular signal(s) printed on the front cover.

c) Insert the spare circuit card(s) and observe the signal(s). If the signal(s) is still absent, continuous, or irregular, withdraw the associated timing generator and insert the spare timing generator circuit card.

NOTE: When replacing the timing generator cards A1 or A12, the rate of the new timing generator should be checked. The timing rate of A1 or A12 should be 20 Hz. This can be checked by adjusting potentiometer R3, located on the timing generator circuit card, clockwise or counterclockwise as necessary until lamp 60 IPM is "blinking" on and off at a rate of 10 times in 10 seconds.

d) If the signal(s) is still absent, continuous, or irregular, make the following voltage checks on the associated Interrupter Power Supply:

Voltage	Power Supply 4865-067 Between Pins
-10V DC	1 and 2
-50V DC	1 and 3

e) If either of the above mentioned voltages are not observed, replace the power supply card with a spare unit.

f) If any output is still absent, continuous, or irregular, the trouble may be in the central office switching equipment. A trouble condition in the central office switching equipment may cause a false indication as indicated by the absent, continuous, or irregular operation of the Interrupter LED's. As a check, transfer the office load to a standby Interrupter and check the main Interrupter again.

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TLX 98-0505 (LORN PROD LORN)

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MEXICO 10, D.F., MEXICO
TEL. 576-82-77
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RECOMMENDED SPARE PARTS LIST
LORAIN MODEL ND INTERRUPTER
SPEC. NO. 5873-808

This Recommended Spare Parts List is arranged alphabetically by part name. Spare parts are not usually required if adequate standby equipment is available and if the LORAIN equipment is installed at an accessible location so that parts can readily be obtained from Lorain Products stock. When ordering parts, please furnish equipment Model No., Spec. No., and Serial No. as given on the equipment nameplate.

LPC Part Number	Description	Quantity of Recm. Spares Minimum Level	On-Site Level	Depot Level
ASSEMBLIES				
4865-067	Power Supply/Contact Protection Circuit PW	-	1	1
4866-095	Interrupter Switch PW	-	1	1
4866-096	Quad Ground Pulse Gate PW	-	1	1
4874-044	Circuit Timing PW	-	1	1
CAPACITORS				
2715-262	0.5UF 600 Volt	-	1	1
FUSES				
2486-107	1.33 Amp Alarm	2	2	2
RESISTORS				
2615-205	2.7 Ohm 1/2 Watt	-	1	1
2656-319	500 Ohm 5 Watt Fixed	-	1	1
SEMICONDUCTORS				
2812-310	200V Silicon Diode, 1N4818	-	2	2

RECOMMENDED SPARE PARTS LIST
LORAIN MODEL ND INTERRUPTER
SPEC. NO. 5873-808

LPC Part Number	Description	Quantity Recm. Spares Minimum Level	On-Site Level	Depot Level
MISCELLANEOUS				
2488-195	Fuseholder	-	-	1

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MEXICO

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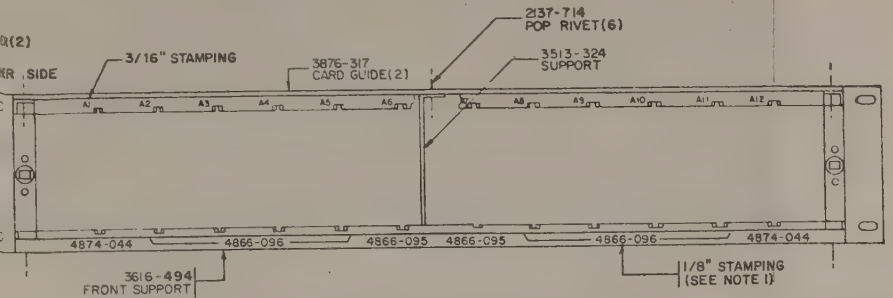
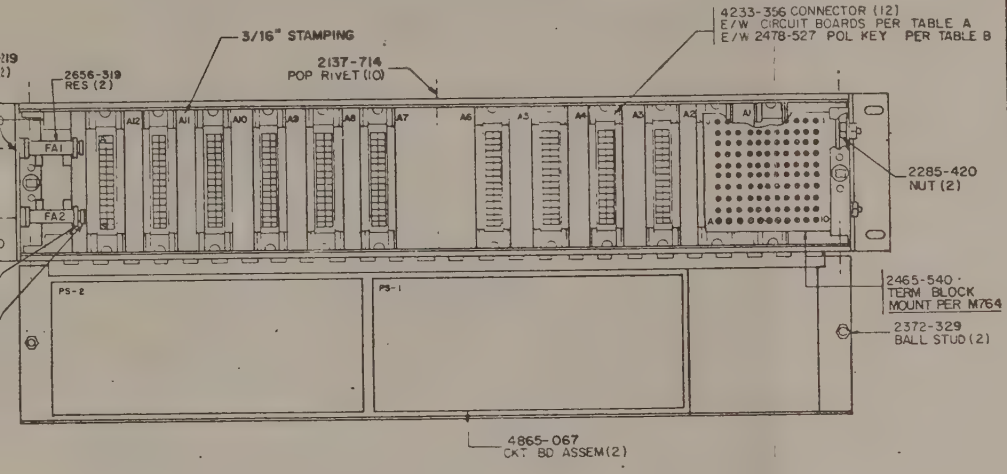
APARTADO POSTAL 77001
MEXICO 10 D F MEXICO
TEL 576 82 77
TLX 01774308 (1774308 LORME

REVISIONS			
NO.	CHNG OR CHG SLIP NO.	DATE	DESCRIPTION
1	M		
2	1836840	5-14-79	S.M.G.
M	3645-511 AND 3461-715 REMOVED.		



FRONT VIEW
(WITH COVER REMOVED)



REAR VIEW
(WITH COVER OPEN)

TABLE A	
DESIG	E/W CIRCUIT BOARD
A1,A12	4874-044
A2-5,A8-11	4866-096
A6,7	4866-095

TABLE B	
DESIG	INSERT IN POSITION
A1	J-8
A2-5,8-11	F-6
A6,7	K-9

NOTE:
1. STAMP CIRCUIT BOARD PART NUMBERS ON FRONT EDGE OF LOWER CARD GUIDE BEFORE ATTACHING 3616-494 FRONT SUPPORT.

184-5040

J5873-808

DUPLICATE ND INTERRUPTER ASSEMBLY

5873-808

DESIGN	DRENNAN
ISS.	2
DRAWN BY	DATE 5-4-77
CHECKED BY	DATE 11-17-77
APPROVED BY	DATE
APPROVED BY	DATE 11-17-77
RATING	STANDARD

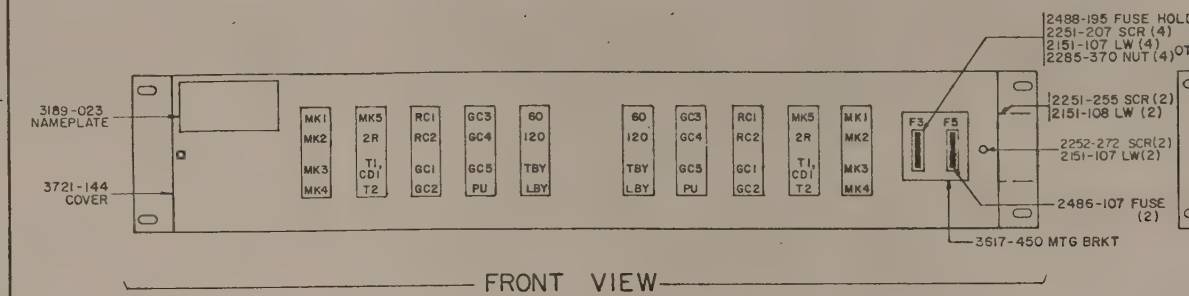
J5873-808

LORAIN PRODUCTS CORPORATION
LORAIN, OHIO
LORAIN PRODUCTS (CANADA) LTD. ST. THOMAS, ONTARIO

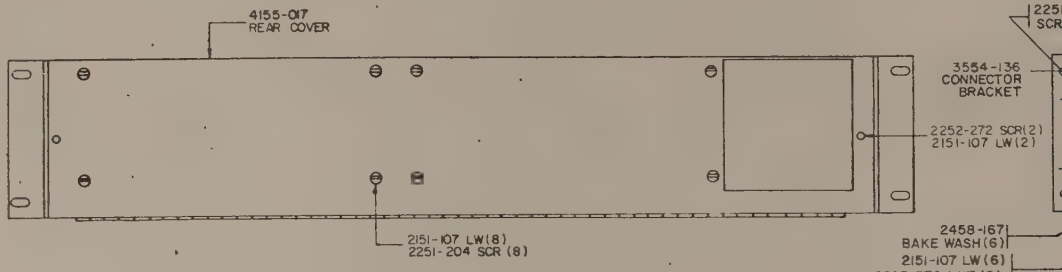
DWG SIZE D

SHEET 1 OF 1

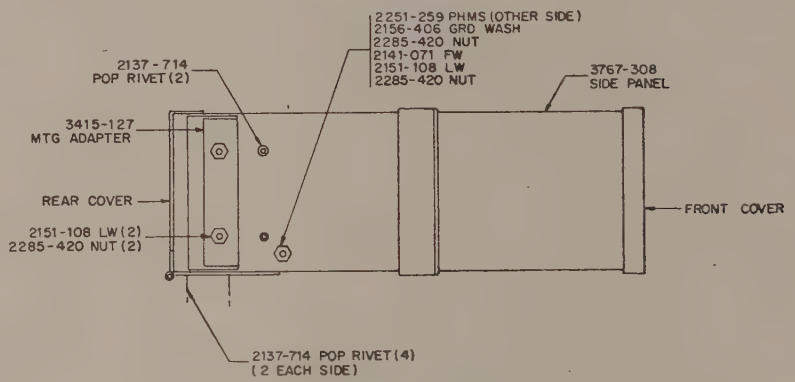
PRINTED IN U.S.A.



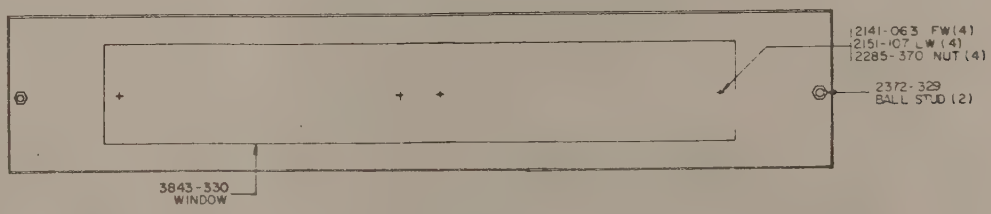
FRONT VIEW



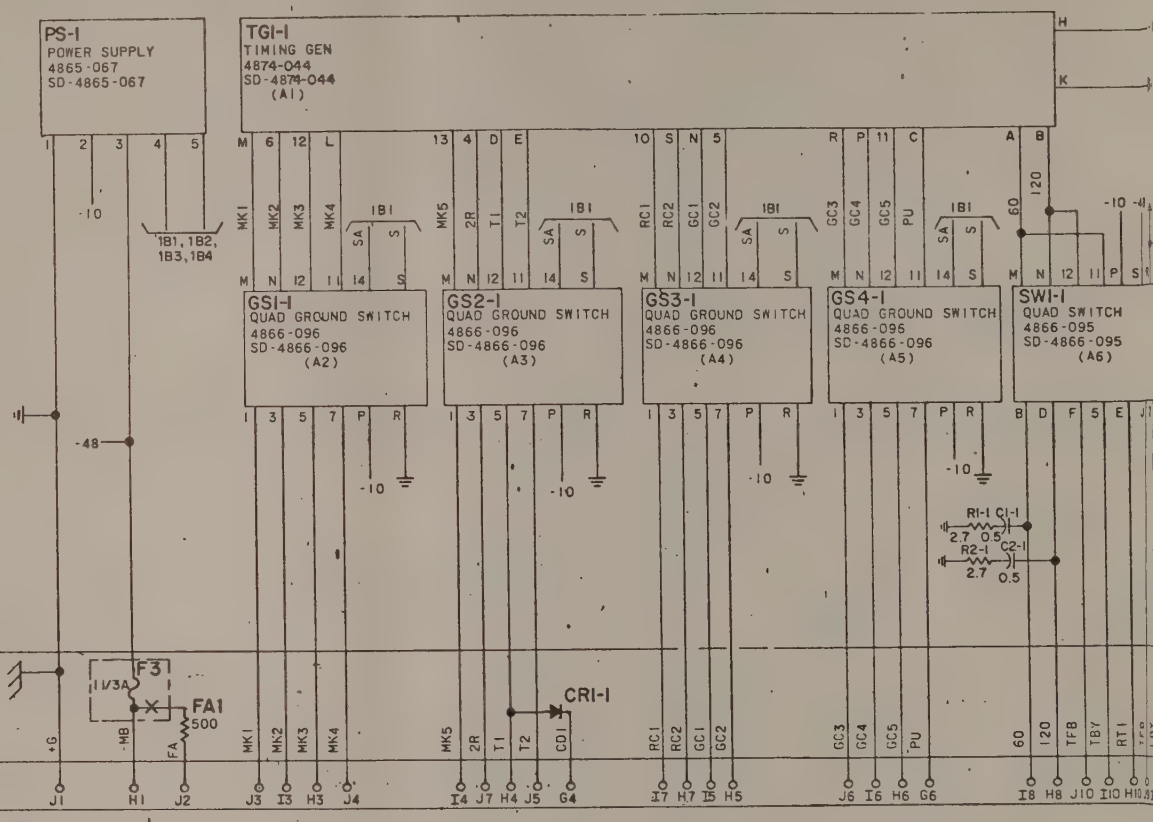
REAR VIEW

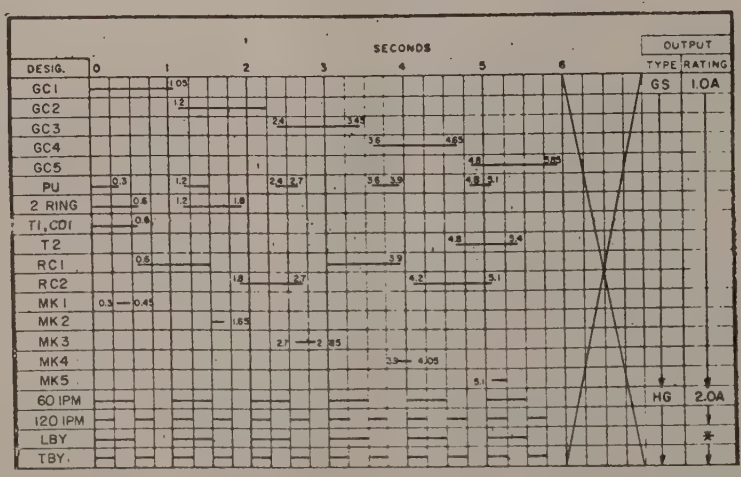


SIDE VIEW

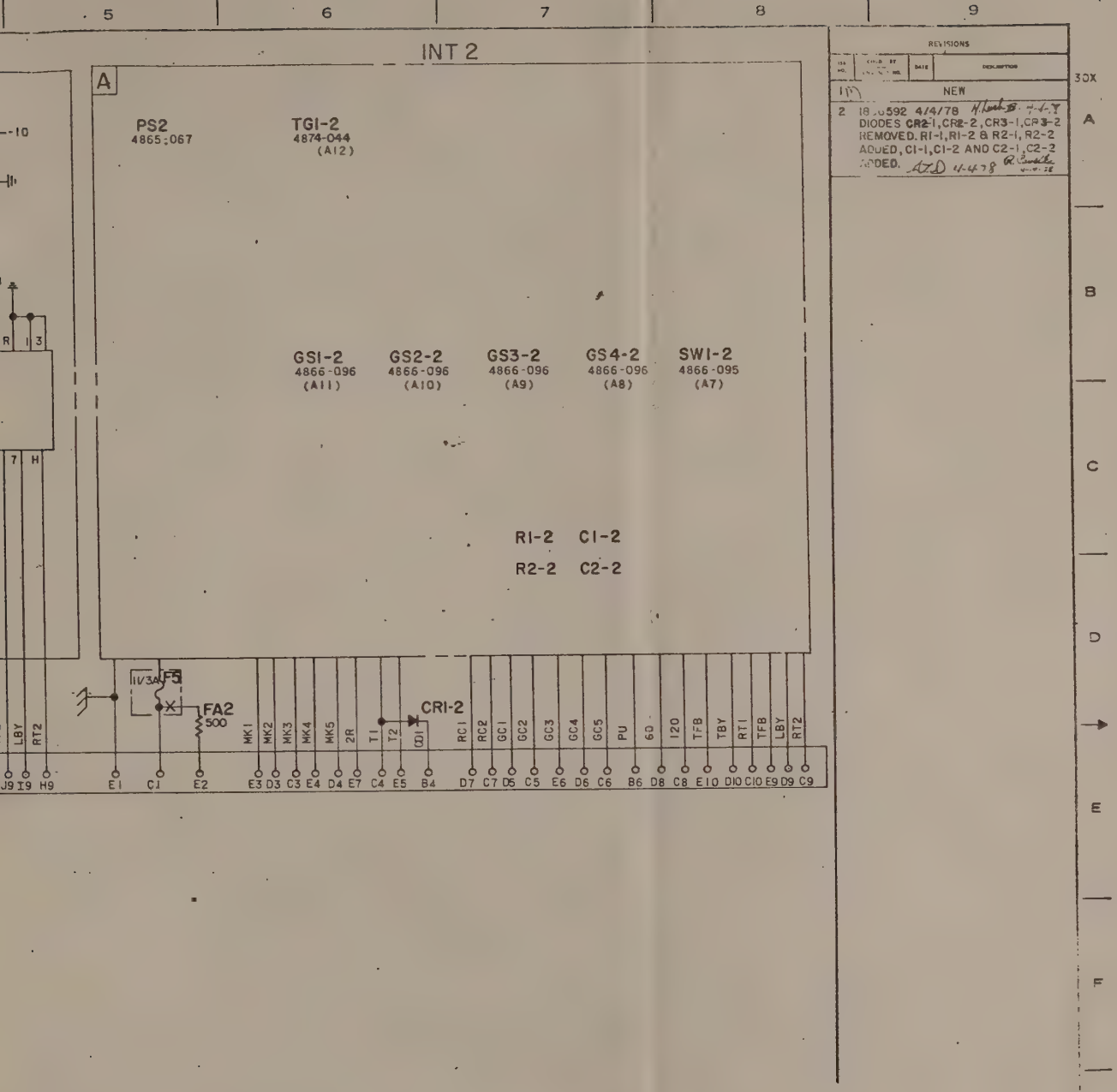


REAR VIEW
(OF FRONT COVER)





——— = SWITCH OUTPUT OR CLOSURE OF NO. MERCURY RELAY CONTACTS
GS = GROUND SWITCH
HG = MERCURY RELAY SWITCH
* = SEE SD-4866-095, NOTE 3



REVISIONS

ECN NO.	CHKD BY ENG. ORD. NO.	DATE	DESCRIPTION
1			NEW
2	18,0592	4/4/78	DIODES CR2-1, CR2-2, CR3-1, CR3-2 REMOVED. RI-1, RI-2 & R2-1, R2-2 ADDED, CI-1, CI-2 AND C2-1, C2-2 ADDED. ATD 4-4-78

30X

184-5040

SD-5873-808

NO DUAL INTERRUPTER

5873-808

DESIGN	DRENNAN SS.
DRAWN BY	H.LASH DATE 7-21-
CHECKED BY	DATE
CHECKED BY	DATE
APPROVED BY	DATE
RATING	STANDARD

SD-5873-808

LORAIN PRODUCTS CORPORATION
LORAIN, OHIO
LORAIN PRODUCTS (CANADA) LTD., ST THOMAS, ONTARIO

DWG SIZE D

SHEET 1 OF

COMPONENT LIST

CAPACITOR

DESIG	CODE	DESCRIPTION
C1	2731-111	20 UF, 100V

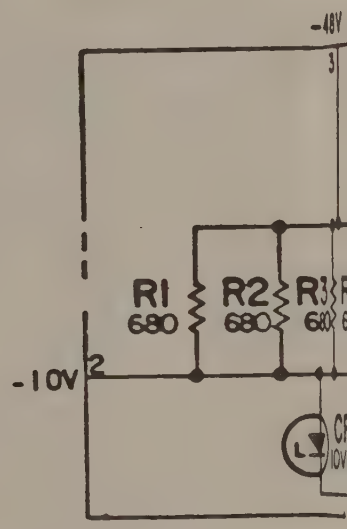
DIODE

DESIG	CODE	DESCRIPTION
CR1	2812-310	1N4818
CR2	2836-213	1N3022B
CR3	2836-132	1N2974RA

} OR EQUAL

RESISTOR

DESIG	CODE	DESCRIPTION
R1-R4	2652-481	680 Ω 1 W
R5	2651-127	10 Ω 3 W



CIRCUIT DESCRIPTION

THIS CIRCUIT PACK CONTAINS A 10 VOLT REGULATED POWER SUPPLY AND A SURGE ABSORBING CIRCUIT TO PROTECT THE OUTPUT TRANSISTORS OF 4866-096 AND SIMILAR GROUND SWITCHES FROM INDUCTIVE VOLTAGE TRANSIENTS ON THE INTERRUPTER GROUND PULSE OUTPUT LEADS. TERMINALS 3 AND 1 ARE THE -48V AND +GROUND INPUTS, RESPECTIVELY.

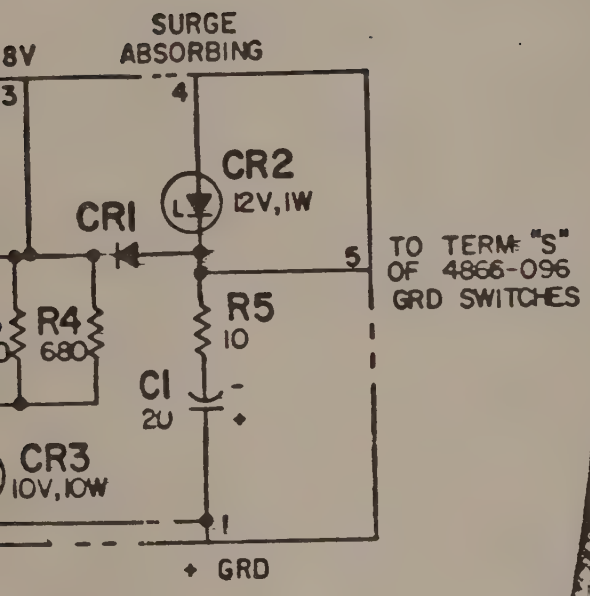
R1-R4 AND CR3 ARE A SHUNT REGULATOR TO PROVIDE -10V DC TO POWER THE IN INTERRUPTER. THE MAXIMUM OUTPUT CURRENT FROM TERMINAL 2 IS 180MA AT 42 INPUT.

R5 LIMITS THE CHARGING CURRENT OF C1 WHEN POWER IS INITIALLY APPLIED TO -48V DC.

WHEN A VOLTAGE TRANSIENT IN EXCESS OF APPROX. 60V (C1 CHARGE VOLTAGE PL OF CR2) APPEARS ON THE "SURGE ABSORBING" LEAD, CR2 CONDUCTS AND C1 CHARG THE SURGE ABSORBING BUS IS CONNECTED TO TERMINAL 4. AFTER THE TRANSIENT OF LED'S TO GROUND ON 4866-096 GROUND SWITCHES SERVE TO DISCHARGE C1 CONNECTED TO TERMINAL 5.

CR1 BLOCKS A SNEAK PATH FROM EXTERNAL -48V BATTERY THRU THE GROUND SWI TO R1-R4 AND CR3. THIS PREVENTS THE POWER SUPPLY FROM OPERATING FROM TH LOAD WHEN THE INTERRUPTER IS STOPPED BY REMOVING ITS -48V INPUT.

REVISIONS			
ISS DOC	CHGD BY / CHG SLIP NO.	DATE	DESCRIPTION
1	M		



LY.

INTEGRATED CIRCUITS IN THE
42V DC INPUT OR 250MA AT 56V

D TO THE CIRCUIT. C1 CHARGES TO

E PLUS THE 12V BREAKDOWN VOLTAGE
HARGES HIGHER, ABSORBING THE TRANSIENT.
IENT PASSES, MULTIPLE SHUNT PATHS
C1 TO -48V. THE LED SUPPLY BUS IS

SWITCH LOAD VIA TERMINAL 4 OR 5
M THE INTERRUPTER GROUND SWITCH

FIRST USED ON	NEXT ASSY	SIZE B
	MODEL NO. NC, ND	

LORAIN PRODUCTS CORPORATION
LORAIN, OHIO
LORAIN PRODUCTS (CANADA) LTD. ST. THOMAS, ONTARIO

POWER SUPPLY AND
SURGE PROTECTION CIRCUIT FOR
NC & ND INTERRUPTERS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON FRACTIONS ±1/32 DECIMALS ±0.031 ANGLES ±1.5°	DESIGN	DATE
	DRAWN GLD	12-12-74
	CHECKED J Drennan	3-6-75
	CHECKED R Pavelka	3-17-75
MATERIAL	APPROVED	3-18-75
	SD-4865-067	
FINISH	SCALE DO NOT SCALE DWG	

COMPONENT LIST

CAPACITOR

DESIG	CODE	DESCRIPTION
C1	(2737-134)	10 UF 20V
(4) C2-C5	(2724-139)	0.001 UF, 1KV
C6	(2731-134)	50 UF, 75V

DIODE

DESIG	CODE	DESCRIPTION
(8) CR1-CR8	(2812-223)	IN5059
(4) CR9-CR12	(2812-310)	IN4818
(4) DS1-DS4	(2812-125)	DIALCO 550-0103
(4) CR13-CR16	(2834-525)	4.7V, 0.4W ZENER

OR EQUAL

INTEGRATED CKT

DESIG	CODE	DESCRIPTION	
(3) A1-A3	(2876-308)	QUAD NOR GATE	CD4001BF
A4	(2871-205)	QUAD LINEAR AMP	LM339
A5	(2876-403)	HEX INVERTER	CD4049BF

OR EQUAL

RESISTOR

DESIG	CODE	DESCRIPTION
(4) R1,R6,R9,R12	(2615-271)	2.2K, 1/2W
(4) R2,R7,R10,R13	(2615-281)	5.6K, 1/2W
(8) R3,R8,R11,R14,R24-R27	(2651-302)	1 OHM, 3W
R4	(2637-225)	10K, 1/2W, 5%
R5	(2637-177)	1K, 1/2W, 5%
(8) R16-R23	(2615-295)	22K, 1/2W

TRANSISTOR

DESIG	CODE	DESCRIPTION
(4) Q1-Q4	(2844-059)	TIP-126 OR EQUAL

CIRCUIT DESCRIPTION

THIS CIRCUIT PACK CONSISTS OF FOUR INDEPENDENT 1 AMPERE GROUND SWITCHES. GATES G1 AND G5 FORM A RS FLIP-FLOP BIASED BY RESISTOR R20 SO THAT PIN 10 OF GATE G1 WILL BE LOW WHEN NO SIGNAL IS PRESENT ON PIN 9 OF GATE G1. WHEN A LOW CONTROL SIGNAL (-12V) IS APPLIED TO PIN 9 OF GATE G1, THE OUTPUT STATE OF THE RS FLIP-FLOP IS UNCHANGED, HOWEVER THE LOW CONTROL SIGNAL IS COUPLED TO PIN 2 OF GATE G2 MAKING THE OUTPUT OF GATE G2 (PIN 3) GO HIGH (+GRD). THIS HIGH SIGNAL IS INVERTED BY GATE G3 AND APPLIED TO THE BASE OF TRANSISTOR Q1 THROUGH RESISTOR R1, CAUSING TRANSISTOR Q1 TO CONDUCT. THE CONDUCTION OF Q1 APPLIES GROUND THROUGH RESISTORS R3 & R24 TO BOARD CONNECTOR PIN 1 (OUTPUT 1).

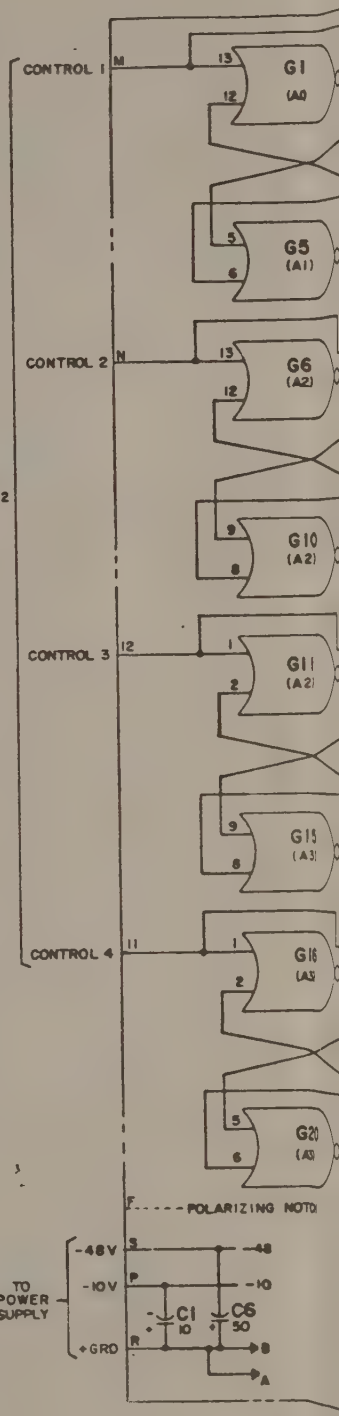
WHEN THE CONTROL SIGNAL IS REMOVED, PIN 3 OF GATE G2 BECOMES LOW, THIS SIGNAL IS INVERTED BY GATE G3 TO A HIGH SIGNAL CAUSING Q1 TO STOP CONDUCTING.

WHEN THE LOAD CURRENT THROUGH RESISTORS R3 & R24 REACHES APPROXIMATELY 2 AMPERES THE VOLTAGE DROP ACROSS THEM IS ONE VOLT. LINEAR AMP G4 COMPARES THIS VOLTAGE TO THE VOLTAGE DEVELOPED ACROSS RESISTOR R5. WHEN THE VOLTAGE ACROSS R3 & R24 IS GREATER THAN THE VOLTAGE ACROSS R5, LINEAR AMP G4 STOPS CONDUCTING, APPLYING A HIGH SIGNAL TO PIN 2 OF GATE G5. THIS VOLTAGE CAUSES THE RS FLIP-FLOP TO TOGGLE SO THAT PIN 10 OF GATE G1 IS HIGH. IN THIS CONDITION THE OUTPUT OF GATE G3 WILL BE LOW (REGARDLESS OF THE STATE OF CONTROL SIGNAL) AND TRANSISTOR Q1 CANNOT CONDUCT UNTIL THE LOAD CURRENT BECOMES LESS THAN 2 AMPERES.

WHEN TRANSISTOR Q1 IS CONDUCTING THE GROUND OUTPUT SIGNAL IS APPLIED TO LIGHT EMITTING DIODE DS1 CAUSING IT TO LIGHT. WHEN Q1 IS NOT CONDUCTING DS1 CEASES TO LIGHT. THEREFORE DS1 WILL PROVIDE A VISUAL INDICATION OF THE CONDUCTING STATE OF THE GROUND SWITCH.

THE THREE REMAINING GROUND SWITCHES FUNCTION IN THE SAME MANNER AS DESCRIBED ABOVE.

TERMINAL 14 IS TO BE CONNECTED TO THE "SURGE ABSORBING" TERMINAL OF POWER SUPPLY UNIT 4865-067 OR EQUAL TO PROTECT THE POWER TRANSISTORS FROM INDUCTIVE VOLTAGE TRANSIENTS ON THE INTERRUPTER GROUND PULSE OUTPUT LEADS.



POWER CONNECTIONS			
DESIG	TYPE	-10	+GRD
A1,A2,A3	CD-4011BF	7	14
A4	LM-339	12	3
A5	CD-4049BF	8	1

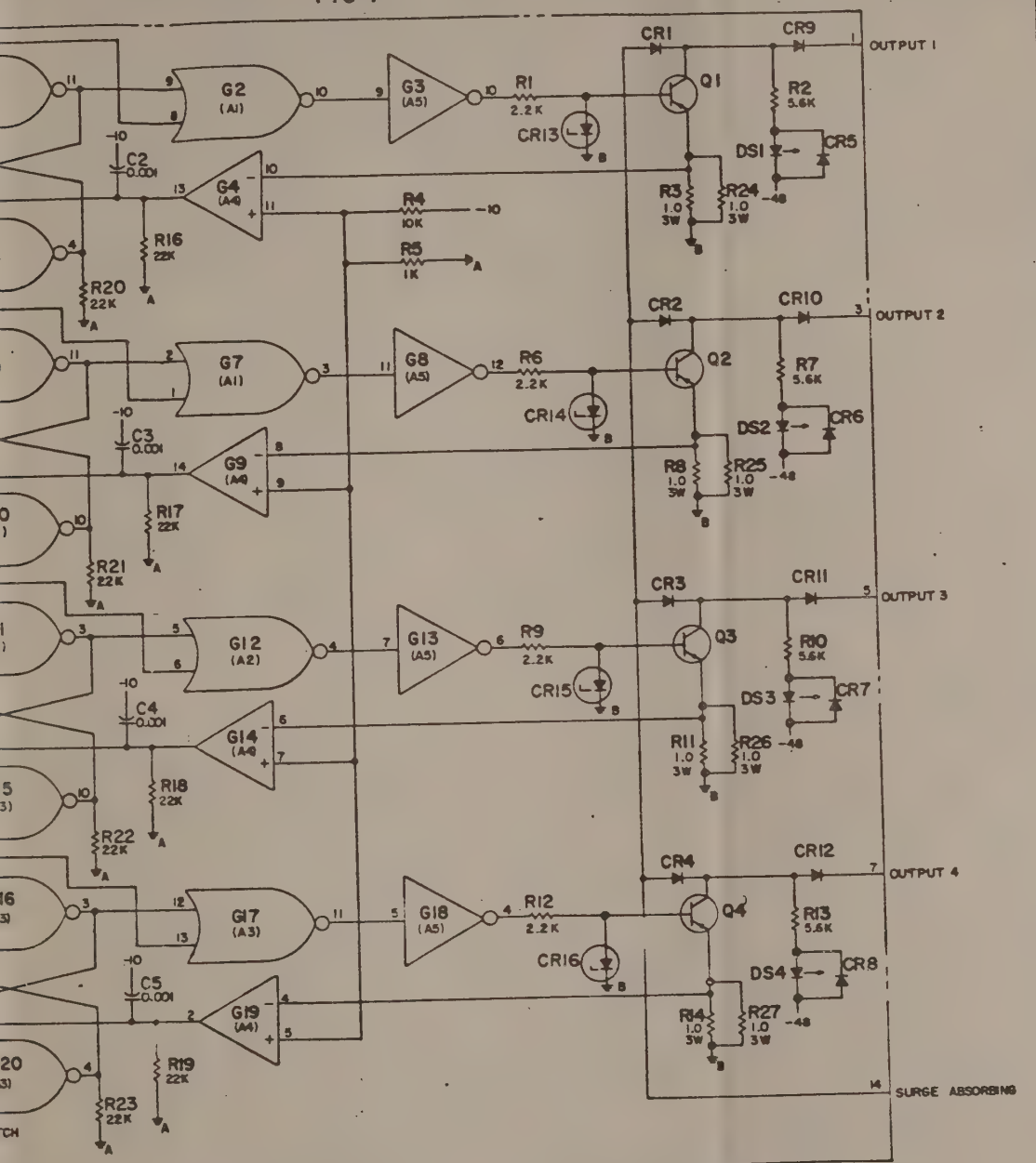
NOTES

1. THE INPUT TERMINALS OF ALL UNUSED GATES, BUFFERS, ETC. SHALL BE TIED TO EITHER -10 VDC., +GROUND OR ANOTHER ACTIVE INPUT LEAD OF THE SAME IC PACKAGE.
2. IF ANY OF THE FOUR GROUND SWITCHES ON THIS CP ARE INACTIVE ON THE APPLICATION DRAWING OF A CONNECTING CIRCUIT, THE INACTIVE INPUT TERMINALS SHALL BE TIED TO +GROUND.

MANUFACTURING REFERENCES

CATEGORY	NUMBER
ASSEMBLY DRAWING	4866-096
P.W. BOARD	3156-626
CONNECTOR ON FRAME	4233-356

FIG 1



REVISIONS				
				30X
1		NEW		
2	1835632	9 CAPACITORS C2-C5 ADDED	11 75	A
3	1835636	9 DIODES CR9-CR12 ADDED.	24 75	
4	1836516	6-6-78 C2-C5 WERE 0.01UF, C6 ADDED. CR13-16 & R24-27 ADDED. R1, 6, 9, 12 WERE 1K. R5 WAS 2.2K D.C. AD 6-26-78		B

DESIGN	JT MITCHELL	SH. 4
DRAWN BY	GD	DATE 9-11-74
CHECKED BY		DATE 8-6-75
APPROVED BY		DATE 8-11-75
APPROVED BY		DATE
RATING	STANDARD	

SD-4866-096

QUAD GROUND SWITCH

LORAIN PRODUCTS CORPORATION
LORAIN, OHIO

DWG SIZE D

SD-4866-096

SHEET 1 OF 1

PRINTED IN U.S.A.

COMPONENT LIST

CAPACITOR

DESIG	CODE	DESCRIPTION
C1	(2737-134)	10 UF, 20V
C2	(2731-134)	50 UF, 75V

DIODE

DESIG	CODE	DESCRIPTION
(4) CR1-CR4	(2812-310)	1N4818
(4) DS1-DS4	(2818-125)	DIALCO 550-0103 } OR EQUAL
(4) CR5-CR8	(2811-101)	1N4148

INTEGRATED CIRCUIT

DESIG	CODE	DESCRIPTION
A1	(2876-402)	HEX BUFFER CD-4050AF OR EQUAL

RELAY

DESIG	CODE	DESCRIPTION
(4) K1-K4	(2543-450)	9850 Ω, 1C (MERCURY)

RESISTOR

DESIG	CODE	DESCRIPTION
(4) R1-R4	(2615-279)	4.7K, 1/2 W
(4) R5-R8	(2615-287)	10K, 1/2 W
(4) R9-R12	(2634-648)	10K, 1/4 W

TRANSISTOR

DESIG	CODE	DESCRIPTION
(4) Q1-Q4	(2843-099)	MPS-A56 OR EQUAL

CIRCUIT DESCRIPTION

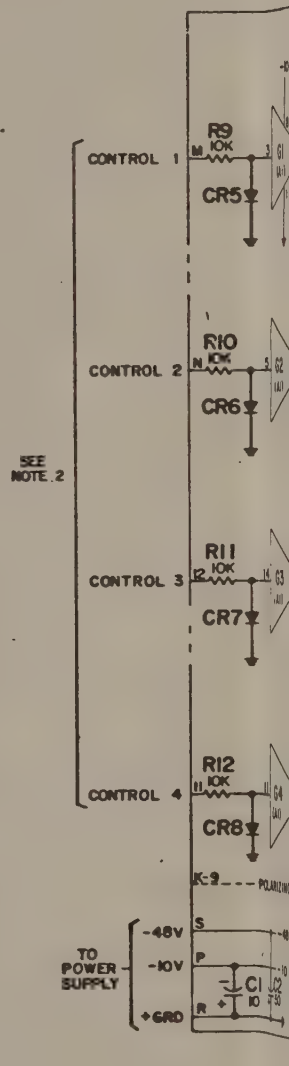
THIS CIRCUIT PACK CONSISTS OF FOUR INDEPENDENT INTERRUPTER SWITCHES.

WHEN A LOW (-10V) CONTROL SIGNAL IS APPLIED TO PIN 3 OF BUFFER A1, THE OUTPUT OF A1 (PIN 2) BECOMES LOW. THIS LOW SIGNAL IS APPLIED TO THE BASE OF TRANSISTOR Q1 THROUGH RESISTOR R1 CAUSING Q1 TO CONDUCT. WHEN Q1 CONDUCTS IT APPLIES GROUND TO RELAY K1 THROUGH LIGHT EMITTING DIODE DS1 CAUSING K1 TO OPERATE AND DS1 TO LIGHT.

WHEN THE CONTROL SIGNAL IS REMOVED Q1 DOES NOT CONDUCT CAUSING K1 TO RELEASE AND DS1 TO EXTINGUISH.

DS1 PROVIDES A VISUAL INDICATION OF THE STATE OF THE INTERRUPTER SWITCH.

THE THREE REMAINING INTERRUPTER SWITCHES FUNCTION IN THE SAME MANNER AS DESCRIBED ABOVE.



NOTES

1. THE INPUT TERMINALS OF ALL UNUSED GATES, BUFFERS, ETC. SHALL BE TIED TO EITHER -10 VDC, + GROUND OR ANOTHER ACTIVE INPUT LEAD OF THE SAME IC PACKAGE.

2. IF ANY OF THE FOUR RELAY DRIVERS ON THIS CP ARE INACTIVE, THE INACTIVE INPUT TERMINALS SHALL BE TIED TO + GROUND.

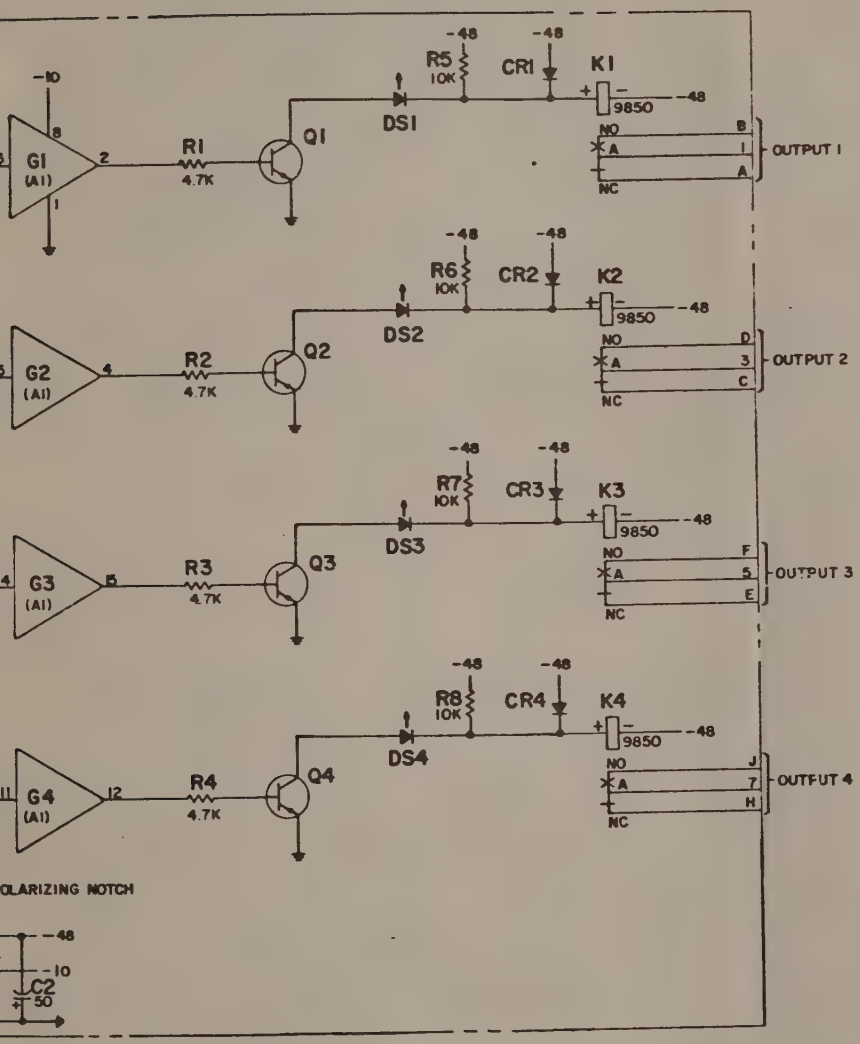
3. THE MAXIMUM RATING OF THE K1-K4 RELAY CONTACTS IS 500 VOLTS (MAX), 2 AMPERES (MAX). THE PRODUCT OF VOLTAGE AND CURRENT MUST NOT EXCEED 100 VA (MAX). THESE CONTACTS MAY BE USED TO INTERRUPT TONE OR RINGING CURRENT WHERE THE CAPACITIVE NATURE OF THE LOAD AUTOMATICALLY PROVIDES THE NECESSARY CONTACT PROTECTION.
   IF NECESSARY TO INTERRUPT AN INDUCTIVE LOAD, CONTACT PROTECTION EXTERNAL TO THE CIRCUIT PACK MUST BE PROVIDED. REFER TO C.P. CLARE & CO. BULLETIN 801, P19 (OR EQUAL) FOR FURTHER DETAILS.

MANUFACTURING REFERENCES	
CATEGORY	NUMBER
ASSEMBLY DRAWING	4866-095
P.W. BOARD	3158-501
CONNECTOR ON FRAME	4233-356

REVISIONS			
DWG NO.	CHNG BY DWG. SUP. NO.	DATE	DESCRIPTION
1			NEW
2	1836516	6-6-78	C2, CR5-8, R9-12 ADDED

D.C. [signature] 6-7-78 [signature] 6-7-78

FIG 1



SD-4866-095	DESIGN J. T. MITCHELL	ISS. 2	
QUAD INTERRUPTER SWITCH	DRAWN BY GLD	DATE 9-10-75	
	CHECKED BY [signature]	DATE 9-6-75	
	APPROVED BY [signature]	DATE 3-11-76	
	APPROVED BY	DATE	
	RATING STANDARD		
	SD-4866-095		
LORAIN PRODUCTS CORPORATION LORAIN, OHIO	DWG SIZE D	SHEET 1 OF 1	

PRINTED IN U.S.A.

COMPONENT LIST

CAPACITOR

DESIG	CODE	
C1	(2737-129)	2.2UF, 35V, TANTALUM
C2	(2715-112)	0.33UF, 100V
C3	(2724-139)	0.001UF, 1000V
C4	(2724-006)	0.01UF, 16V
C5	(2737-134)	10UF, 20V, TANTALUM

DIODE

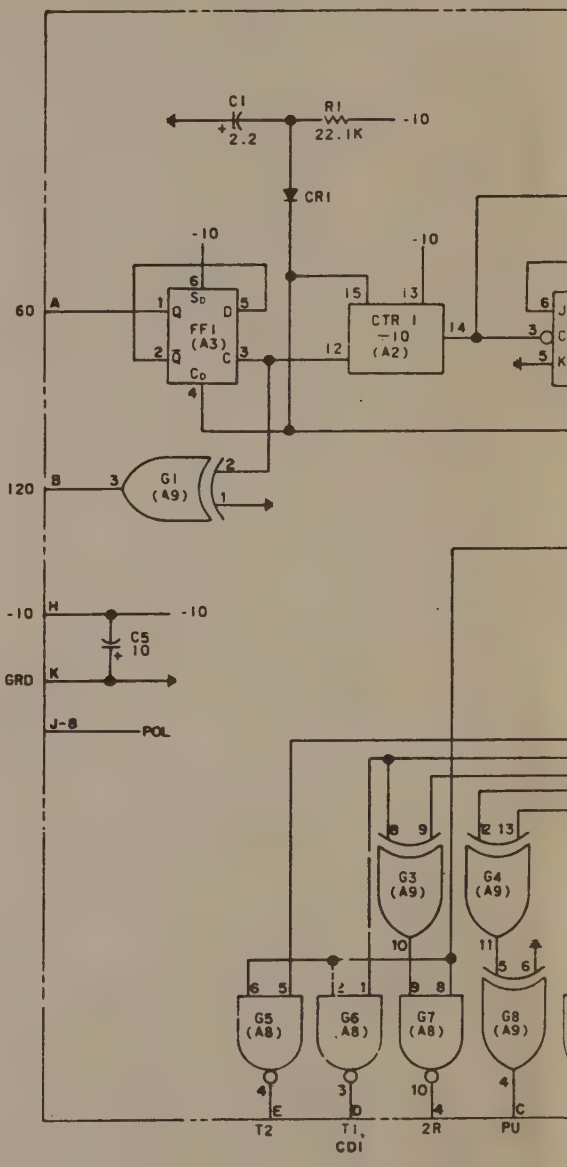
DESIG	CODE	
(4)CR1-4	(2811-101)	IN4148 OR EQUAL

INTEGRATED CIRCUIT

DESIG	CODE		
A1	(2871-001)	NE-555	
A2	(2876-505)	CD-4017	
(2)A3,7	(2876-101)	CD-4013	
A4	(2876-102)	CD-4027	OR EQUAL
(2)A5,6	(2876-504)	CD-4022	
(4)A8,10,11,12	(2876-301)	CD-4011	
A9	(2876-304)	CD-4030	

RESISTOR

DESIG	CODE	
(2)R1,7	(2635-687)	22.1K, 1W, 1%
R2	(2635-726)	150K, 1W, 1%
R3	(2675-125)	50K, POT.
R4	(2635-689)	24.3K, 1W, 1%
R5	(2635-673)	10K, 1W, 1%
R6	(2635-624)	1K, 1W, 1%



CIRCUIT DESCRIPTION

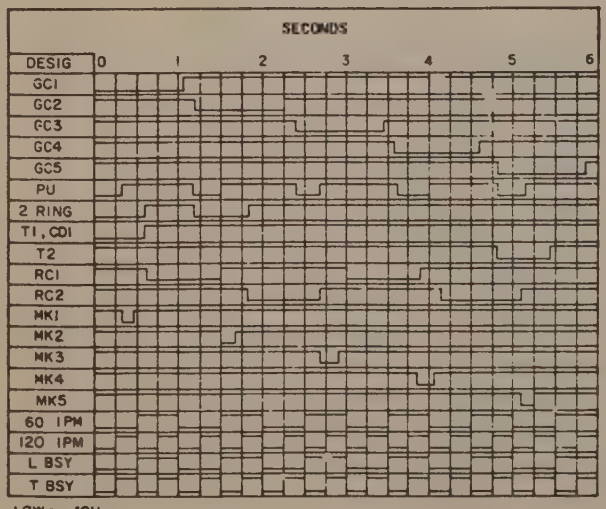
THIS CIRCUIT CONSISTS OF A CLOCK, COUNTER AND DECODER CIRCUITS.

THE CLOCK, CONSISTING OF A1, R2-4 AND C2-3, IS A FREE RUNNING PULSE GENERATOR OPERATING AT 20 HZ. POTENTIOMETER R3 ADJUSTS THE PULSE REPITION RATE.

THE COUNTER, CONSISTING OF A2-7, C1 AND C4, CR1-4 AND R1, R5-7, PRODUCES THE BASIC TIMING PATTERN FROM THE CLOCK PULSE.

THE DECODER, CONSISTING OF A8-12, DECODES THE BASIC TIMING PATTERN INTO THE DESIRED OUTPUT SIGNALS TO DRIVE EXTERNAL LOAD SWITCHES.

THIS CIRCUIT OPERATES FROM A REGULATED 10 VOLT SUPPLY AND TYPICALLY DRAWS 10 MA.

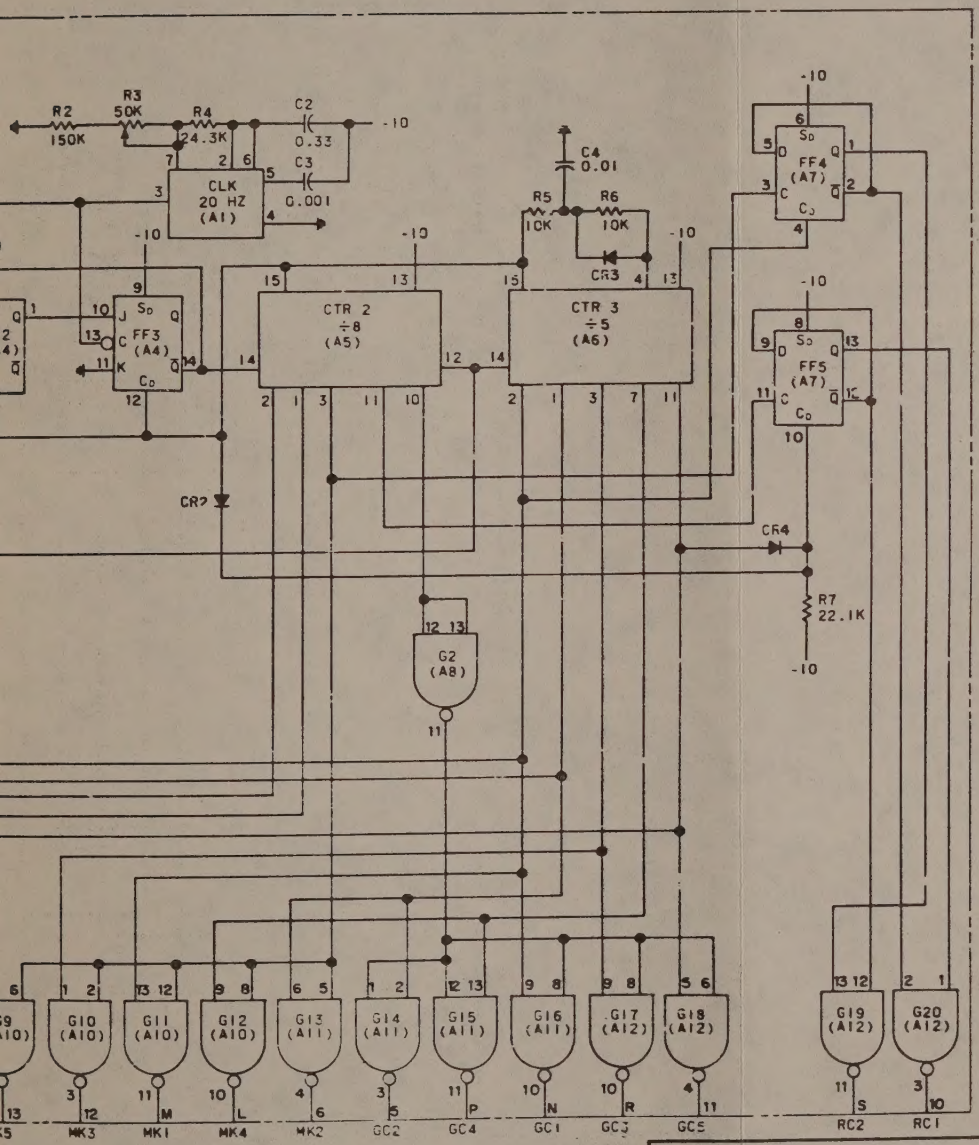


LOW = -10V
HIGH = +GRD

REVISIONS			
REV NO.	CHGD BY / CHG SLIP NO.	DATE	DESCRIPTION
1			NEW

MANUFACTURING REFERENCES

CATEGORY	NUMBER
ASSEMBLY DRAWING	4874-044
P W BOARD	3158-570
CONNECTOR ON FRAME	4233-356



NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS; VALUES PRECEDED BY THE SYMBOL +(PLUS) OR -(MINUS) ARE IN VOLTS.
2. CODES WITHIN PARENTHESES, AS (2737-129) REPRESENT LPC PART NUMBERS.
3. POWER CONNECTIONS

DESIG	-10V	+GRD
A1	1	8
A2	8	16
A3	7	14
A4	8	16
A5	8	16
A6	8	16
A7	7	14
A8	7	14
A9	7	14
A10	7	14
A11	7	14
A12	7	14

184-5040

TIMING CIRCUIT

DESIGN	G DRENNAN	SS
DRAWN BY	J REESE	DATE 3-2-77
CHECKED BY		DATE
CHECKED BY		DATE
APPROVED BY		DATE
RATING	STANDARD	

SD-4874-044

LORAIN PRODUCTS CORPORATION
LORAIN, OHIO
LORAIN PRODUCTS CANADA LTD ST THOMAS ONTARIO

DWG SIZE D

SHEET 1 OF